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NATIONAL DAM SAFETY PROGRAM. RISS LAKE DAM (MO 20128), MISSOURI--ETC(U)
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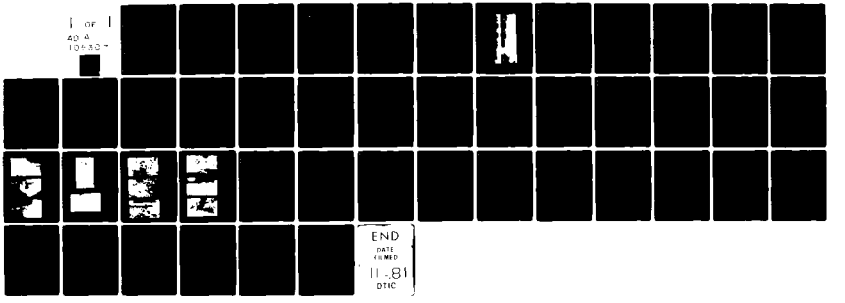

MISSOURI LEVEL II

MISSOURI-KANSAS CITY BASIN

RISS LAKE DAM

JACKSON COUNTY, MISSOURI

MO 20128

AD A105307

PHASE 1 INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

PREPARED BY: HOSKINS-WESTERN-SONDEREGGER, INC.

FOR: STATE OF MISSOURI

SEPTEMBER, 1978

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UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE *(When Data Entered)*

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1. REPORT NUMBER	2. GOVT ACCESSION NO. AD-A105 307	3. RECIPIENT'S CATALOG NUMBER
4. TITLE *(and Subtitle)* Phase I Dam Inspection Report National Dam Safety Program Riss Lake Dam (MO 20128) Jackson County, Missouri	5. TYPE OF REPORT & PERIOD COVERED Final Report 6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) Hoskins-Western-Sonderegger, Inc.	8. CONTRACT OR GRANT NUMBER(s) DACW43-70-C-0155
9. PERFORMING ORGANIZATION NAME AND ADDRESS U.S. Army Engineer District, St. Louis Dam Inventory and Inspection Section, LMSED-PD 210 Tucker Blvd., North, St. Louis, Mo. 63101	10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
11. CONTROLLING OFFICE NAME AND ADDRESS U.S. Army Engineer District, St. Louis Dam Inventory and Inspection Section, LMSED-PD 210 Tucker Blvd., North, St. Louis, Mo. 63101	12. REPORT DATE September 1978 13. NUMBER OF PAGES Approximately 40
14. MONITORING AGENCY NAME & ADDRESS *(if different from Controlling Office)* National Dam Safety Program. Riss Lake Dam (MO 20128), Missouri - Kansas City Basin, Jackson County, Missouri. Phase I Inspection Report.	15. SECURITY CLASS. *(of this report)* UNCLASSIFIED 15a. DECLASSIFICATION/DOWNGRADING SCHEDULE
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18. SUPPLEMENTARY NOTES

19. KEY WORDS *(Continue on reverse side if necessary and identify by block number)*

Dam Safety, Lake, Dam Inspection, Private Dams

20. ABSTRACT *(Continue on reverse side if necessary and identify by block number)*

This report was prepared under the National Program of Inspection of Non-Federal Dams. This report assesses the general condition of the dam with respect to safety, based on available data and on visual inspection, to determine if the dam poses hazards to human life or property.

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SECURITY CLASSIFICATION OF THIS PAGE *(When Data Entered)*

DEPARTMENT OF THE ARMY
ST. LOUIS DISTRICT, CORPS OF ENGINEERS
210 NORTH 12TH STREET
ST. LOUIS, MISSOURI 63101

IN REPLY REFER TO

SUBJECT: Riss Lake Dam Phase I Inspection Report

This report presents the results of field inspection and evaluation of the Riss Lake Dam:

It was prepared under the National Program of Inspection of Non-Federal Dams

This dam has been classified as unsafe, non-emergency by the St. Louis District as a result of the application of the following criteria:

1) Spillway will not pass 50 percent of the Probable Maximum Flood
2) Overtopping could result in dam failure.
3) Dam failure significantly increases the hazard to loss of life downstream

SUBMITTED BY: SIGNED
Chief, Engineering Division

26 FEB 1979
Date

APPROVED BY: SIGNED
Colonel, CE, District Engineer

26 FEB 1979
Date

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PHASE I REPORT

NATIONAL DAM SAFETY PROGRAM

Name of Dam	Riss Lake Dam
State Located	Missouri
County Located	Jackson County
Stream	Tributary to Round Grove Creek
Date of Inspection	September 21, 1978

Riss Lake Dam was inspected by an interdisciplinary team of engineers ~~from Hoskins-Western-Sonderegger, Inc.~~ The purpose of the inspection was to make an assessment of the general condition of the dam with respect to safety, based upon available data and visual inspection, in order to determine if the dam poses hazards to human life or property.

The guidelines used in the assessment were furnished by the Department of the Army, Office of the Chief of Engineers, and developed with the help of several Federal and State agencies, professional engineering organizations, and private engineers. Based on these guidelines, this dam is classified as an intermediate-size dam with a high downstream hazard potential. Failure would threaten life and property. The estimated damage zone extends three miles downstream of the dam. Within the damage zone are three to four houses and associated buildings, one railroad crossing, and four improved road crossings.

Our inspection and evaluation indicates that the spillway does not meet the criteria set forth in the guidelines for a dam having the above size and hazard potential. The spillway will not pass a 100-year flood (flood having a one percent chance of being exceeded in any year). The spillway will pass 12% of the Probable Maximum Flood without overtopping the dam. The Probable Maximum Flood (PMF) is defined as the flood that may be expected from the most severe combination of critical meteorologic and hydrologic conditions that are reasonably possible in the region.

Seepage and stability analyses comparable to the requirements of the "Recommended Guidelines for Safety Inspection of Dams" were not available, which is considered a deficiency. These analyses should be obtained in the future.

Deficiencies visually observed by the inspection team were dense growth of trees, bushes, and weeds growing on the crest as well as both slopes, numerous erosion pockets in the downstream slope, low spots in the crest of the dam where water ponds, severe erosion of the spillway channel, and the channel downstream from the eroded spillway is clogged with trees and brush.

Several items of preventive maintenance need to be initiated by the owner. These are described in detail in the body of the report.

H. P. Hoskins

Harold P. Hoskins, P.E.
Hoskins-Western-Sonderegger, Inc.
Lincoln, Nebraska

PHOTO NO. 1
OVERVIEW LOOKING WEST TO DAM

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM
RISS LAKE DAM
ID NO. MO 20128

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Sheet 8 of 10	Spillway Rating Curve
Sheet 9 of 10	Dam Rating Curve
Sheet 10 of 10	Combined Outfall Rating Comp.

SECTION 1 - PROJECT INFORMATION

1.1 GENERAL

a. Authority. The National Dam Inspection Act, Public Law 92-367, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a program of safety inspection of dams throughout the United States. Pursuant to the above, the St. Louis District, Corps of Engineers, District Engineer directed that a safety inspection of Riss Lake Dam be made.

b. Purpose of Inspection. The purpose of the inspection was to make an assessment of the general condition of the dam with respect to safety, based upon available data and visual inspection, in order to determine if the dam poses hazards to human life or property.

c. Evaluation Criteria. Criteria used to evaluate the dam were furnished by the Department of the Army, Office of the Chief of Engineers, in "Recommended Guidelines for Safety Inspection of Dams." These guidelines were developed with the help of several Federal agencies and many State agencies, professional engineering organizations, and private engineers.

1.2 DESCRIPTION OF PROJECT

a. Description of Dam and Appurtenances.

(1) This dam is an earth embankment about 800 feet in length and 42 feet in height. Topography around the dam is moderately steep. Materials on the slopes consist of loess or reworked loess soils underlain by shales and limestones.

(2) The spillway consists of a channel at the left abutment. Headcut erosion caused a partial breach in 1977. An embankment plug was subsequently constructed in the eroded spillway with a broomed concrete invert to carry low flows.

(3) An 8-inch drawdown siphon penetrates the embankment near the normal pool level at center line station 2+80.

(4) Pertinent physical data are given in Paragraph 1.3 below.

b. Location. The dam is located in the west central portion of Jackson County, Missouri, as shown on Plate 2. The dam and the lake formed by the dam are shown on Plate 1 in the NW¼ of Section 28, T49N, R32W.

c. Size Classification. Criteria for determining the size classification of dams and impoundments are presented in the guidelines referenced in paragraph 1.1c, above. Based on these criteria, this dam and impoundment are in the intermediate-size category.

d. Hazard Classification. Guidelines for determining hazard classification are presented in the same guidelines as referenced in paragraph c, above. Based on referenced guidelines, this dam is in the High-Hazard Classification. The estimated damage zone extends three miles downstream from the dam. Within this zone are three to four houses and associated buildings, one railroad crossing and four improved road crossings.

e. Ownership. This dam is owned by BMA Properties, Inc., BMA Tower, Kansas City, Missouri 64141. Attention: Kent F. Turner.

f. Purpose of Dam. The dam forms a 21-acre ± recreational lake.

g. Design and Construction History. No design or construction data were available. The dam was constructed in the early 1930's by the W.P.A. The impoundment covers a former limestone quarry.

h. Normal Operating Procedure. There are no established procedures for operating the drawdown siphon. No information was available on the fluctuation of the lake level. It was reported that flow passed over the top of the dam for several hours in 1977. This overtopping resulted from a rain reportedly of more than 12 inches in the area.

1.3 PERTINENT DATA

a. Drainage Area - 292 acres (0.457 square miles).

b. Discharge at Damsite.

(1) All discharge at damsite is through an uncontrolled spillway with earth channel and poured concrete floor.

(2) Estimated maximum flood at damsite-discharge unknown but probably occurred in 1977.

(3) The spillway capacity varies from 0 c.f.s. at spillway crest (930.0 feet) to 156 c.f.s. at low point of dam crest (931.9 feet).

(4) There is no emergency spillway.

c. Elevations (Feet above M.S.L.).

(1) Top of Dam (low point) - 931.9

(2) Spillway crest - 930.0

(3) Streambed at center line of dam - 890.0±.

(4) Maximum tailwater - unknown.

d. Reservoir. Length of maximum pool (Top of Dam) - 1900 feet±.

e. Storage (Acre-feet).

Top of dam (low point) - 190
Spillway crest - 150

f. Reservoir Surface (Acres).

(1) Top of dam (low point) - 23±

(2) Spillway crest - 21±.

g. Dam.

(1) Type - earth embankment

(2) Length - 800 feet±

(3) Height - 42 feet±

(4) Top width - 18 feet to 24 feet

(5) Side slopes

(a) Downstream - 3.0 to 4.4H on 1V - average 3.5H on 1V (measured with hand level)

(b) Upstream - exposed slope - 3H on 1V

(6) Zoning - unknown

(7) Impervious core - unknown

(8) Cutoff - unknown

(9) Grout curtain - unknown

(10) Riprap - the upstream face is plated with hand-placed limestone rock, generally less than 12 inches in maximum dimension.

h. Diversion and/or Regulation. None

i. Spillway

(1) Principal

(a) Type - Earth and rock channel with spillway floor of rough poured concrete smoothed by hand rake.

(b) Central section - Approximate bottom width of 20 feet and varying side slopes averaging about 9:1.

(c) Crest elevation - 930.0 feet m.s.l.

(d) Upstream channel - None

(e) Downstream channel - Filled with fallen trees and brush and badly eroded.

(2) Emergency - None

j. Regulating Outlet - Eight-inch pipe siphon with gate valve. Motor operated with intake approximately 20 feet below water surface. Used only to lower lake in case of emergency.

SECTION 2 - ENGINEERING DATA

2.1 DESIGN

No design data were available for this dam.

2.2 CONSTRUCTION

No construction data were available, although it was reported that the dam was built in the 1930's by the W.P.A.

2.3 OPERATION

An eight-inch siphon has been installed near station 2+80 as a drawdown works. It was reported that the siphon could lower the lake as much as one foot per day, when in operation, and that the siphon inlet was about 20 feet below the permanent pool level. There were no other controlled discharge structures for this dam.

2.4 EVALUATION

a. Availability. There were no engineering data available for this dam.

b. Seepage and stability analyses. Seepage and stability analyses comparable to the requirements of the "Recommended Guidelines for Safety Inspection of Dams" were not available, which is considered a deficiency. These seepage and stability analyses should be performed for appropriate loading condition and made a matter of record.

SECTION 3 - VISUAL INSPECTION

3.1 FINDINGS

a. General. A visual inspection of Riss Lake Dam was made on September 21, 1978. Engineers from the firm of Hoskin-Western-Sonderegger, Inc., making the inspection were: Stephen Nickel, Geology and Soil Mechanics, Gordon Jamison, Hydrology and Hydraulics, Garold Ulmer, Civil Engineer, and Richard Walker, Hydrology. Specific observations are discussed below.

b. Dam. The upstream slope has a covering of hand-placed riprap, through which weeds, bushes, and trees up to 10 inches in diameter are growing. Neither slides nor serious erosion were noted in the upstream slope. The crest and the downstream slope were also covered with a dense growth of trees, bushes, weeds, and grass. No seeps or slides were noted on the downstream slope, although there were numerous small depressions up to 2 feet in diameter and up to 1 foot deep. These holes appeared to be erosion pockets which could have developed during overtopping of the dam in 1977. The soils exposed on the surface of the dam were found to be silty clay (CL) and clay (CH). The dense growth of trees, bushes, weeds, and grasses on the upstream and downstream slopes of the dam and on the crest made evaluation of surface conditions extremely difficult.

The abutments are mantled with silty clay (CL) soils which overlie shales and limestones. It was reported that the reservoir area was originally a limestone quarry and that the center and north portions of the embankment sit above a nearly vertical limestone cut face. However, no seepage was noted in the abutments, on the downstream slope, or at the downstream toe. Some low areas were found on the crest where water had ponded and where cracks were evident. The cracks were parallel to the axis of the dam but were not over 5 or 10 feet long. They appeared to be shrinkage cracks.

c. Appurtenant Structures. The spillway consists of an earth channel, with a broomed concrete invert, that drops sharply down the left abutment. The spillway channel follows the route of the original spillway channel, but the flowline has eroded up to 20 feet vertically at some locations. The original limestone masonry walls of the spillway channel remain, generally intact, high above the existing flowline. It was reported that head-cutting erosion of the spillway channel began shortly after construction and reached the dam during high flows in 1977. At that time, erosion of the channel lowered the lake level about 7 feet. The spillway was then repaired in order to bring the lake back to its normal level. A plug of compacted soil was constructed in the eroded spillway channel. The plug is about 100

feet long, gently sloping on top, and steeply sloping on the downstream side. The concrete spillway invert is constructed on this earth plug and stops when it reaches the eroded spillway channel. At station 2+80 there is an 8-inch steel siphon that has been installed as a drawdown works. The intake is reported to be about 20 feet below the normal pool level. Where the siphon passes through the embankment, its top is at the normal pool level. After emerging from the embankment, the pipe rests on the downstream slope with an unprotected discharge about 30 feet below the downstream toe. The siphon was carrying no flow at the time of the inspection. The uncontrolled spillway and the drawdown siphon are the only structures to control pool levels at this dam.

d. Reservoir Area. No wave wash, excessive erosion, or slides were observed along the shore of the reservoir.

e. Downstream Channel. The channel below the eroded spillway is poorly defined and is clogged with trees and brush. About 1000 feet downstream from the dam the channel crosses under a paved road. The exact location of the channel in the trees could not be determined from the road.

f. Downstream Hazards. The downstream hazards are described in Section 5.

3.2 EVALUATION

The trees on the upstream and downstream slopes of the dam and on the crest, if left uncontrolled, have the potential of causing failure of the dam by piping along the roots. The crest requires regrading to prevent the ponding of water. The spillway requires immediate attention. Any large spillway flow could wash out the plug embankment.

SECTION 4 - OPERATIONAL PROCEDURES

4.1 PROCEDURES

No regulating procedures exist for the operation of the drawdown siphon. It was reported that water flowed over the top of the dam in 1977.

4.2 MAINTENANCE OF DAM

The growth of trees, bushes, and weeds on the embankment and the severe erosion of the original spillway indicate the lack of regular maintenance.

4.3 MAINTENANCE OF OPERATING FACILITIES

The drawdown siphon was recently installed and shows no lack of maintenance.

4.4 DESCRIPTION OF WARNING SYSTEM IN EFFECT

The inspection team is not aware of any warning system at this dam.

4.5 EVALUATION

Trees and brush growing on the embankment could lead to the potential of failure if not controlled.

SECTION 5 - HYDRAULIC/HYDROLOGIC

5.1 EVALUATION OF FEATURES

a. Design Data. No design data were found for this dam.

b. Experience. The drainage area, reservoir surface area, and elevation-storage data were developed from the U.S.G.S. Independence, Missouri (7.5 minute) Quadrangle topographic map. The hydraulic computations for the spillway and dam overtopping discharge ratings were based on information obtained from field measurements made during the field inspection.

c. Visual Observations.

(1) It would appear that the spillway floor would be subject to severe erosion in case of a major flood.

(2) Spillway exit channel conditions could cause considerable scour to downstream side of dam.

(3) The spillway is part of the left abutment of the dam and high flows in the spillway could cause problems to the dam.

(4) The heavy growth of trees on both the upstream and downstream faces could also cause severe problems.

d. Overtopping Potential. The spillway is too small to pass the one-half Probable Maximum Flood or the 100-year flood without overtopping. The spillway will pass 12% of the Probable Maximum Flood without overtopping. The results of the routings through the reservoir are tabulated in regards to the following conditions.

Frequency	Peak Inflow Discharge c.f.s.	Peak Outflow Discharge c.f.s.	Maximum Pool Elevation	Freeboard Top of Dam Min. Elev. 931.9	Time Dam Overtopping Hrs.
100-Yr.	640	550	932.6	-0.7	3.5
1/2 PMF	1440	1370	933.2	-1.3	6.2
PMF	2880	2810	933.9	-2.0	10.2
0.12 PMF	330	160	931.9	0	--

According to the recommended guidelines from the Department of the Army, Office of the Chief of Engineers, this dam is classified as having a high hazard rating and an intermediate size. Therefore, the PMF is the test for the adequacy of the dam and its spillways.

The St. Louis District, Corps of Engineers, in a letter dated 11 August, 1978, has estimated the damage zone as extending three miles downstream from the dam. Within the damage zone are three to four houses and associated buildings, one railroad crossing, and four improved road crossings.

SECTION 6 - STRUCTURAL STABILITY

6.1 EVALUATION OF STRUCTURAL STABILITY

a. Visual Observations. Visual observations of items which adversely affect the stability of the dam are discussed in Section 3. These include the following features: brush and trees on the embankment faces and crest, low areas on the crest which permit water to pond, and the erosion-damaged spillway which has been repaired in what must be considered a temporary manner.

b. Design and Construction Data. No design or construction data were available.

c. Operating Records. The only structure capable of being operated is the drawdown siphon. No operating records exist for this structure.

d. Post-Construction Changes. The drawdown siphon has been constructed recently. It penetrates the dam just below the normal pool elevation at center line station 2+80. No seepage was noted where the siphon emerges onto the downstream slope. The siphon should pose no hazard to the stability of the dam. The deteriorated condition of the spillway and the repairs that have been performed constitute a hazard to the integrity of the embankment.

e. Seismic Stability. This dam is in Seismic Zone 1. An earthquake of the magnitude used for design in this zone is not expected to cause structural failure of this dam.

SECTION 7 - ASSESSMENT/REMEDIAL MEASURES

7.1 DAM ASSESSMENT

a. Safety. Several items were noted during the visual inspection which could seriously threaten the safety of the dam if not controlled. These items include uncontrolled vegetation on the slopes and crest of the dam, the presence of low areas on the crest where water can pond, and the deteriorated condition of the spillway. The Probable Maximum Flood will overtop the dam. The spillway will pass 12% of the PMF before the dam is overtopped.

Overtopping of this dam in 1977 had no reported major effect downstream.

b. Adequacy of Information. Since no engineering or construction data were available, the conclusions of this report are based upon performance history and visual observations. The inspection team considers that these data are sufficient to support the conclusions herein. Neither a seepage nor a stability analysis was found. This is a deficiency which should be corrected in the near future. Additional studies would be required to assess downstream hazards due to overtopping and/or breaching of this dam.

c. Urgency. The remedial measures recommended in paragraph 7.2 should be accomplished as soon as possible.

d. Necessity for Phase II. A Phase II investigation is not called for. However, additional engineering data and analyses should be obtained by the owner, at the owner's expense, to evaluate and design recommended remedial measures.

e. Seismic Stability. The dam is located in Seismic Zone 1. An earthquake of the magnitude used for design in this seismic zone is not expected to be hazardous to this dam.

7.2 REMEDIAL MEASURES

a. Alternatives. If breaching of this dam due to overtopping will endanger life or property downstream, the size of the spillway and/or the height of the dam should be increased and/or the permanent pool elevation should be lowered so that the Probable Maximum Flood can be passed without overtopping the dam. Regardless of which of these alternatives is chosen, additional investigations and analyses should be conducted to determine the structural characteristics and stability of the present embankment. These investigations should include a determination of

whether high seepage pressures exist beneath the embankment or the downstream toe and the application of these findings in the stability analysis. The services of an engineer experienced in the design of dams should be obtained to perform the investigations and analyses of the present dam and to design the appropriate modifications and remedial measures.

b. O & M Maintenance and Procedures. The following O & M maintenance and procedures are recommended.

(1) A program should be developed and put into action to remove trees and brush from the dam and to control other vegetation.

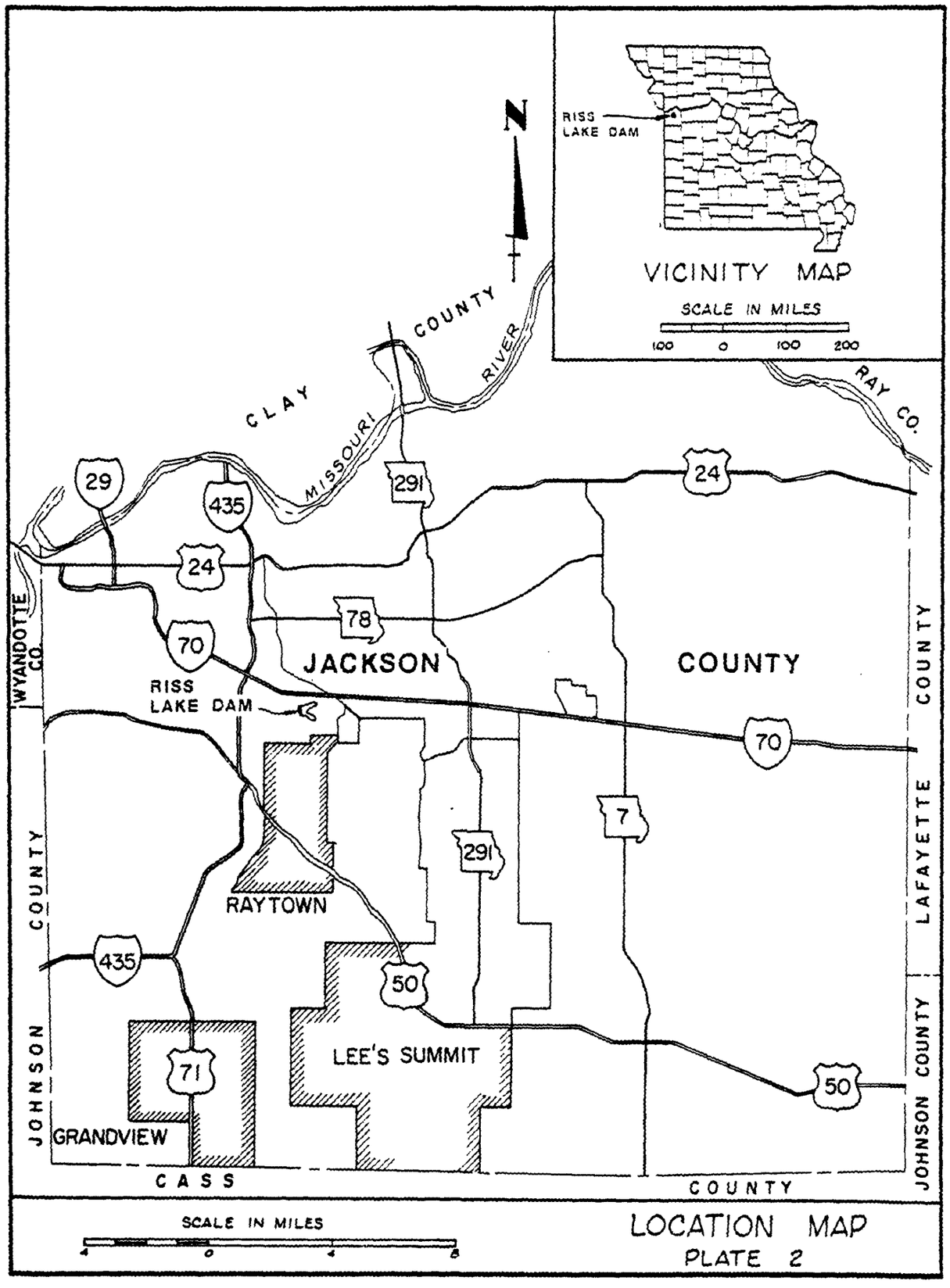
(2) The crest should be regraded to permit proper surface drainage.

(3) The spillway should be restored in such a manner that erosion will no longer threaten the embankment or the spillway itself. This work should be planned in conjunction with the consideration of the alternatives in paragraph a., above.

(4) The dam should be inspected regularly by qualified personnel to determine the presence of seepage on the downstream slope, in the abutments, below the downstream toe, or in the spillway channel, to determine the presence of slides in the downstream slope, and to observe the upstream slope for any erosional damage.

APPENDIX A
MAPS


Pitcher Cem
IBM 988
Pitcher Sch
Fairview Sch
Shopping Center
Riss Lake
Northwood Sch
Sewage Disposal
St Bernadette Sch
Brookings Sem
Mt Carmel Cem
RAYTOWN
SCALE IN FEET
2000 1000 0 2000 4000
1000 500 0 1000
SCALE IN METERS
N
RISS LAKE DAM
VICINITY TOPOGRAPHY
PLATE I


RISS
LAKE DAM
VICINITY MAP
SCALE IN MILES
100 0 100 200
N
CLAY COUNTY
MISSOURI RIVER
RAY CO.
29
435
291
24
78
70
WYANDOTTE CO.
JACKSON
COUNTY
RISS
LAKE DAM
7
RAYTOWN
50
LEE'S SUMMIT
71
GRANDVIEW
JOHNSON COUNTY
LAFAYETTE COUNTY
JOHNSON COUNTY
CASS
COUNTY
SCALE IN MILES
LOCATION MAP
PLATE 2

APPENDIX B
PHOTOGRAPHS

PHOTO NO. 2
UPSTREAM SLOPE
FROM SPILLWAY
INLET

PHOTO NO. 3
UPSTREAM SLOPE
FROM RIGHT
ABUTMENT

PHOTO NO. 4
LOOKING NORTH
FROM CENTER LINE
STATION 2+00

PHOTO NO. 5
LOW AREA ON CREST CENTER LINE STATION 1+95. NOTE PENCIL POINTING TO CRACK AT BOTTOM OF PHOTO

PHOTO NO. 6
SIPHON ENTERING EMBANKMENT AT CENTER LINE STATION 2+80

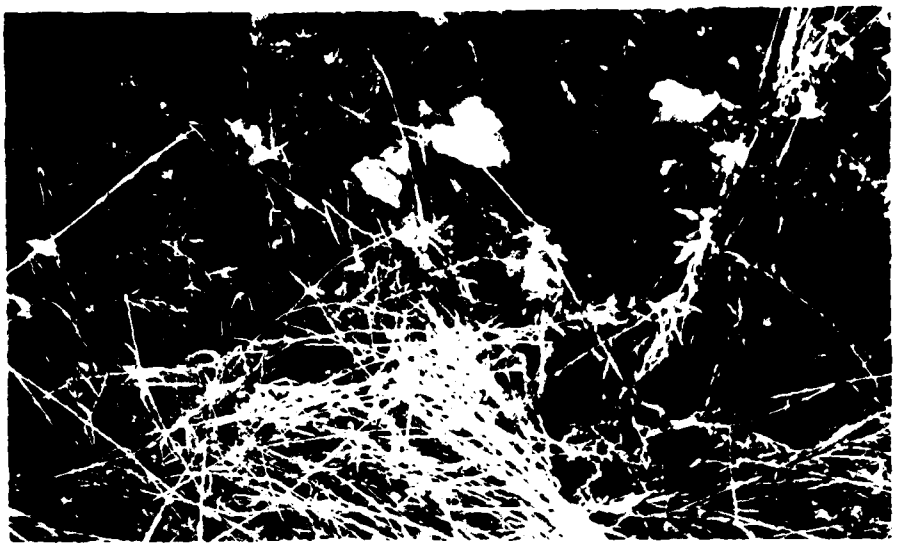


PHOTO NO. 7
SIPHON ON
DOWNSTREAM
SLOPE

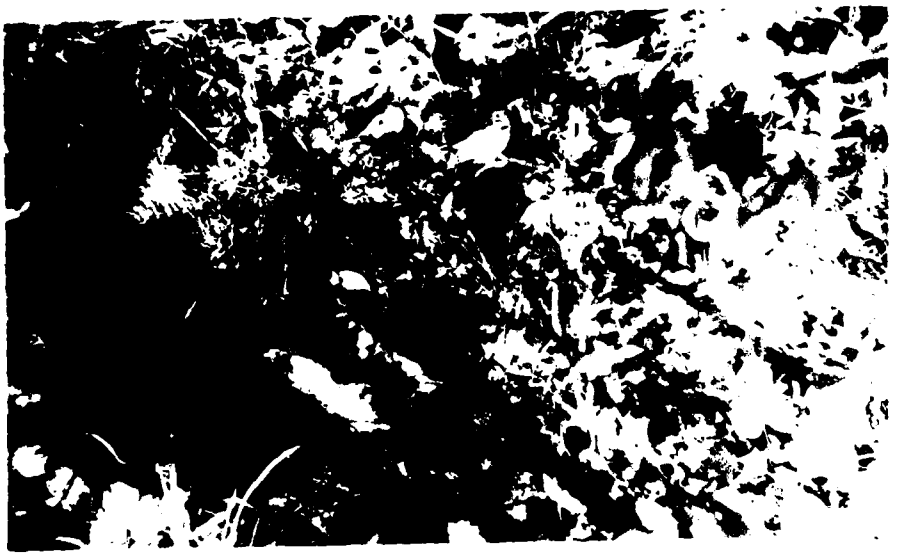


PHOTO NO. 8
SIPHON OUTLET
WITH NO FLOW

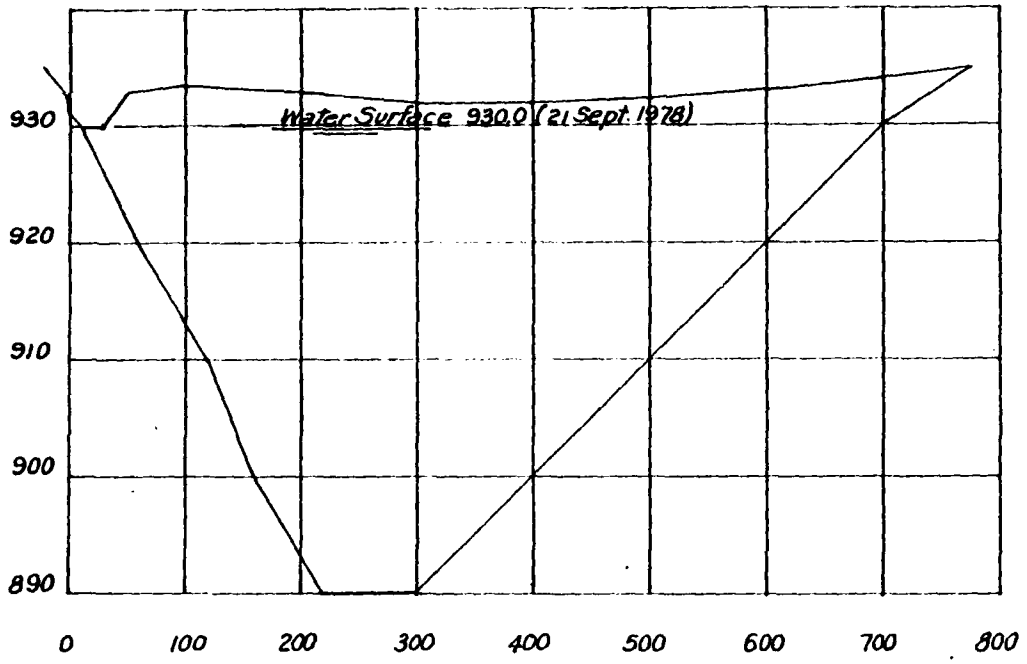
PHOTO NO. 9
LOOKING UPSTREAM
IN SPILLWAY

PHOTO NO. 10
LOOKING DOWN-
STREAM IN
SPILLWAY

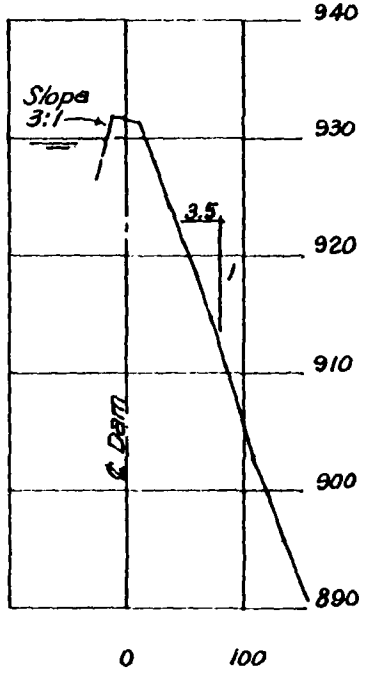
PHOTO NO. 11
LOOKING UPSTREAM
AT DOWNSTREAM
SLOPE OF DAM

PHOTO NO. 12
LOOKING UPSTREAM
IN EXIT CHANNEL
1000 FEET BELOW
DAM

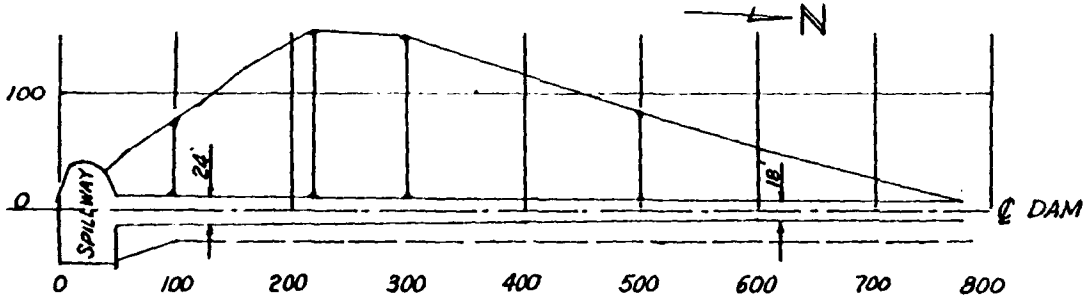
APPENDIX C
PLAN, SECTION AND PROFILE



PROFILE OF DAM

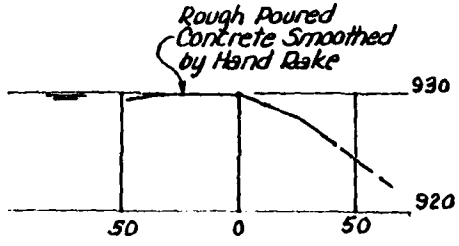


CROSS SECTION AT STA. 3+00



PLAN OF DAM

RISS LAKE DAM
NATIONAL DAM SAFETY PROGRAM
PHASE I



PROFILE OF SPILLWAY

APPENDIX D
HYDROLOGIC COMPUTATIONS

HYDROLOGIC COMPUTATIONS

1. The Mockes dimensionless standard curvilinear unit hydrograph and the SCS TR-20 program were used to develop the inflow hydrographs (see Plate D1). The inflow hydrograph for the 100-year flood was generated by the consultant using the TR-20 program.

   a. Six-hour, twelve-hour, and twenty-four-hour 100-year rainfall for the dam location was taken from NOAA Technical Paper 40. The 24-hour probable maximum precipitation was taken from the curves of Hydrometeorological Report No. 33 and current Corps of Engineers and St. Louis District policy and guidance for hydraulics and hydrology.

   b. Drainage area = 0.457 square mile (292 acres).

   c. Time of concentration of runoff = 25 minutes.

   d. The antecedent storm conditions were heavy rainfall and low temperatures which occurred on the previous 5 days (SCS AMC III). The initial pool elevation was assumed at the crest of the emergency spillway.

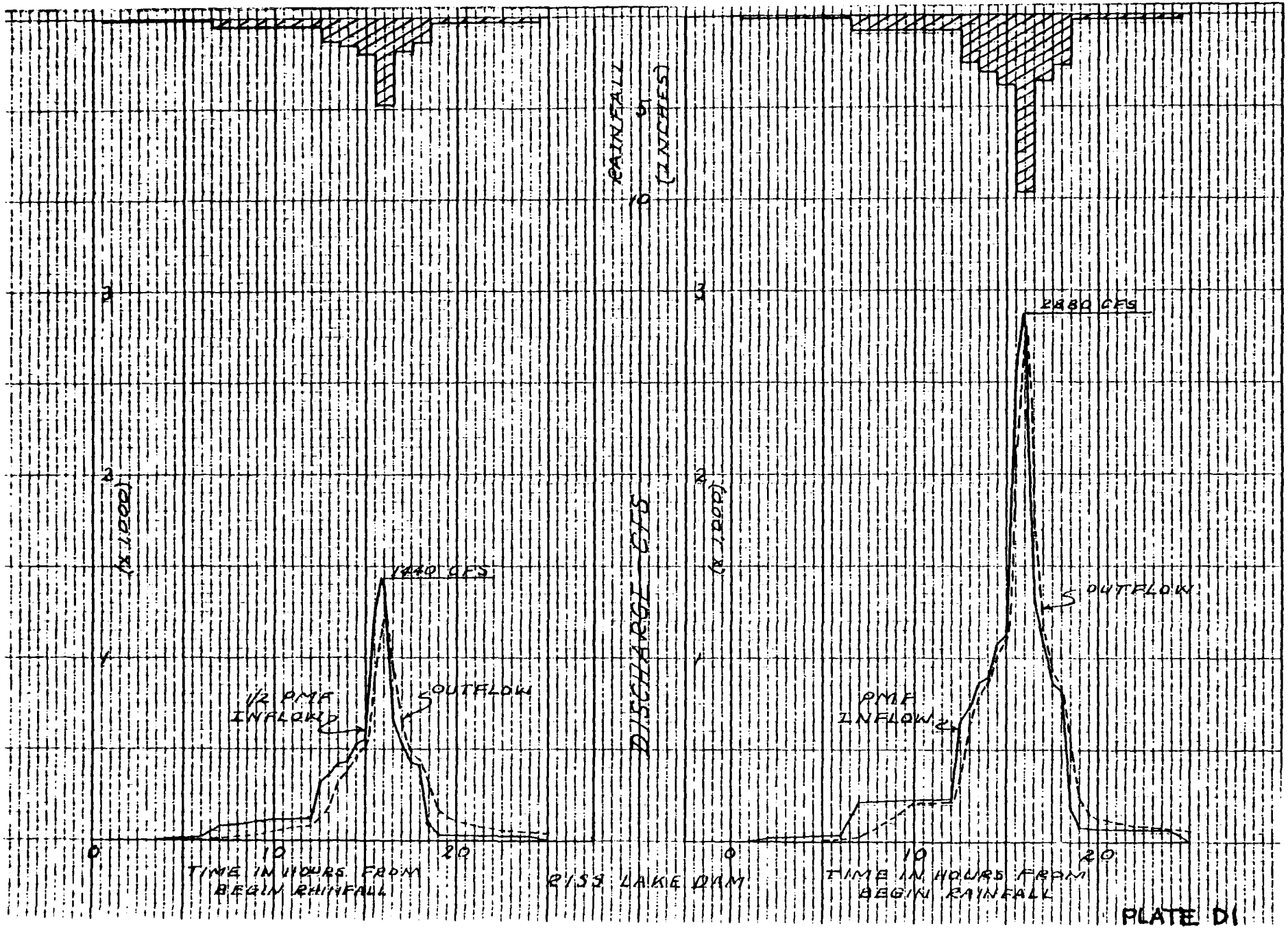
   e. The total 24-hour storm duration losses for the 100-year storm were 1.27 inches. The total losses for the 24-hour duration 1/2 PMF storm were 1.39 inches. The total losses for the PMF storm were 1.62 inches. These data are based on soils B group, woods and urbanized cover weighted to produce SCS input runoff curve No. 85 from SCS AMC II converted by TR-20 to curve No. 94 SCS AMC III.

   f. Average soil loss rates = 0.05 inch per hour approximately.

2. The emergency spillway discharge rating was developed using the Corps of Engineers Surface Water Profile HEC-2 computer program. The flow over the dam crest was computed by two methods due to effect of the numerous trees on the upstream face of the dam near the upstream crest. Flows were first computed using the broad-crested weir equation $Q = CLH^{1.5}$ with the effective Length reduced due to the trees by application of the contraction formula $L = L' - 2(NK_p + K_a)H_e$ as found in USBR publication Design of Small Dams. The Corps of Engineers HEC-2 computer program was also used so that values of "n" could be applied. The HEC-2 program gave higher heads for the same discharge, indicating more head-loss effect due to the trees. A copy of the spillway, top-of-dam, and combined rating curves are attached. The HEC-2 rating was therefore used for the dam overtopping.

3. Floods were routed through the reservoir using the TR-20 program to determine the capabilities of the spillways and dam embankment crest.

The unit hydrograph computation duration interval is computed as 0.17 Tc by the TR-20 program. The input-output data for the TR-20 program used to develop the hydrographs for the PMF, 0.5 PMF, and 100-year flood are attached. The storm rainfall patterns, inflow hydrographs and routed outflow hydrographs are shown on Plate D1.



PISS LAKE DAM

PLATE D1

HYDROLOGY PROGRAM FOR IBM 1130 - DATED JULY, 1968

MO DAM INSP-RISS LAKE DAM TR-20 ROUTING.

EXECUTIVE CONTROL CARD OPERATION LIST

MO DAM INSP-RISS LAKE DAM

C TABLE VELOCITY INCREMENT = 0.200

8	0.0000	0.0800	0.1800	0.2500	0.3200
8	0.3700	0.4100	0.4500	0.4900	0.5100
8	0.5400	0.5700	0.5900	0.6100	0.6300
8	0.6500	0.6600	0.6700	0.6900	0.7000
8	0.7100	0.7200	0.7300	0.7400	0.7500
8	0.7600	0.7700	0.7700	0.7800	0.7900
8	0.7900	0.8000	0.8100	0.8100	0.8200
8	0.8200	0.8300	0.8300	0.8400	0.8400
8	0.8400	0.8500	0.8500	0.8600	0.8600
8	0.8600	0.8600	0.8700	0.8700	0.8700
8	0.8800	0.8800	0.8800	0.8900	0.8900
8	0.8900	0.8900	0.8900	0.8900	0.9000
8	0.9000	0.9000	0.9000	0.9000	0.9100
8	0.9100	0.9100	0.9100	0.9100	0.9100
8	0.9200	0.9200	0.9200	0.9200	0.9200
8	0.9200	0.9200	0.9200	0.9300	0.9300
9 ENDTBL					

STRUCTURE NO. 1

	ELEVATION	DISCHARGE	STORAGE
8	930.0001	0.0000	150.0000
9 ENDTBL			

DIMENSIONLESS HYDROGRAPH - DELTA T =484.00

8	0.0000	0.0300	0.1000	0.1900	0.3100
8	0.4700	0.6600	0.8200	0.9300	0.9900
8	1.0000	0.9900	0.9300	0.8600	0.7800
8	0.6800	0.5600	0.4600	0.3900	0.3300
8	0.2800	0.2410	0.2070	0.1740	0.1470
8	0.1260	0.1070	0.0910	0.0770	0.0660
8	0.0550	0.0470	0.0400	0.0340	0.0290
8	0.0250	0.0210	0.0180	0.0150	0.0130
8	0.0110	0.0090	0.0080	0.0070	0.0060
8	0.0050	0.0040	0.0030	0.0020	0.0010
8	0.0000	0.0000	0.0000	0.0000	0.0000
9 ENDTBL					

RAINFALL TABLE NO. 1 TIME INCREMENT = 0.50

8	0.0000	0.0080	0.0170	0.0260	0.0350
8	0.0450	0.0550	0.0650	0.0760	0.0870
8	0.0990	0.1120	0.1250	0.1400	0.1560
8	0.1740	0.1940	0.2190	0.2540	0.3030
8	0.5150	0.5830	0.6240	0.6540	0.6820
8	0.7050	0.7270	0.7480	0.7670	0.7840
8	0.8000	0.8160	0.8300	0.8440	0.8570
8	0.8700	0.8820	0.8930	0.9050	0.9160
8	0.9260	0.9360	0.9460	0.9550	0.9650
8	0.9740	0.9830	0.9920	1.0000	1.0000
9 ENDTBL					

RAINFALL TABLE NO. 2 TIME INCREMENT = 0.02

8	0.0000	0.0100	0.0200	0.0200	0.0300
8	0.0400	0.0500	0.0600	0.0700	0.0800
8	0.1000	0.1100	0.1300	0.1400	0.1700
8	0.1900	0.2200	0.2700	0.3500	0.4400
8	0.5200	0.6000	0.6300	0.6600	0.6800
8	0.7000	0.7200	0.7400	0.7600	0.7700
8	0.7900	0.8000	0.8200	0.8300	0.8400
8	0.8500	0.8700	0.8800	0.8900	0.9000
8	0.9100	0.9200	0.9300	0.9400	0.9500
8	0.9567	0.9633	0.9700	0.9800	0.9900
8	1.0000	1.0000	1.0000	1.0000	1.0000
9 ENDTBL					

RAINFALL TABLE NO. 3 TIME INCREMENT = 0.50

PMP

8		0.3600	0.4400	0.5100	0.5900	0.6600
8		0.7400	0.8100	0.8900	1.2600	1.6700
8		2.0600	2.4500	2.8400	3.2300	3.6200
8		4.0200	4.4100	4.8100	5.2000	5.6000
8		6.8600	8.1300	9.6500	11.1700	13.0700
8		14.9700	19.7700	24.5800	26.3500	28.1200
8		29.5100	30.9000	31.0100	31.1300	31.2400
8		31.3600	31.4700	31.5800	31.6900	31.8000
8		31.9100	32.0200	32.1300	32.2400	32.2400
9	ENDTBL					

RAINFALL TABLE NO. 4 TIME INCREMENT = 0.50

100-Yr

8		0.0000	0.0300	0.0600	0.0900	0.1200
8		0.1500	0.1800	0.2100	0.2400	0.2700
8		0.3000	0.3300	0.3600	0.4500	0.5400
8		0.6300	0.7200	0.8100	0.9000	0.9900
8		1.0800	1.1700	1.2700	1.3600	1.4600
8		1.7400	2.0300	2.3700	2.7100	3.1300
8		3.5600	4.6400	5.7300	6.1300	6.5300
8		6.8400	7.1600	7.2000	7.2500	7.2900
8		7.3400	7.3800	7.4300	7.4700	7.5200
8		7.5600	7.6100	7.6500	7.7000	7.7000
9	ENDTBL					

STANDARD CONTROL INSTRUCTIONS

SUBRTN	XSECTN	STRCT	HYDROGRAPHS IN1	IN2	OUT	DATA NO. 1	DATA NO. 2	DATA NO. 3	OUTPUT OPTIONS PK	H	E	V	PH	SM
RUNOFF	0	1	0	0	6	0.457	85.000	0.410	1	1	0	1	0	0
RESVOR	0	1	6	0	7	930.000	0.000	0.000	1	1	1	1	0	0

ENDATA

END OF LISTING

ADDITIONS TO TABULAR DATA FOLLOW

STRUCTURE NO. 1

8	930.0001	0.0000	150.0000
8	930.5001	10.0000	160.0000
8	931.0001	36.0000	170.0000
8	931.5001	89.0000	181.0000
8	931.9000	156.0000	191.0000
8	932.2000	265.0000	197.0000
8	932.5001	430.0000	204.0000
8	933.0001	895.0001	215.0000
8	933.5001	1810.0002	228.0000
8	934.0001	3130.0004	240.0000

EXECUTIVE CONTROL CARD OPERATION INCREM. MAIN TIME INCREMENT= 0.25
EXECUTIVE CONTROL CARD OPERATION COMPUT. FROM XSECTN/STRUCT 0/) TO XSECTN/STRUCT 0/ 1
STARTING TIME= 0.00 RAIN DEPTH= 1.00 RAIN DURATION= 1.00 RAIN TABLE NO.= 3 SOIL CONDITION= 3
ALTERNATE NO.= 1 STORM NO.= 1

PMF

SUBROUTINE RUNOFF STRUCTURE 1
AREA= 0.45 INPUT RUNOFF CURVE= 85.0 TIME OF CONCENTRATION= 0.41
COMPUTED CURVE NO. = 94.0

PEAK TIMES	PEAK DISCHARGES	PEAK ELEVATIONS
4.15	29.294	(RUNOFF)
5.09	33.364	(RUNOFF)
10.06	229.711	(RUNOFF)
11.04	231.149	(RUNOFF)
15.88	2876.777	(RUNOFF)
20.02	69.645	(RUNOFF)
23.62	64.820	(RUNOFF)

HYDROGRAPH, TZERO= 1.00 DELTA T= 0.25 DRAINAGE AREA= 0.45

TIME										
1.00	DISCHG	0.00	1.32	4.45	8.40	12.55	15.14	16.72	19.61	22.88	23.47
3.50	DISCHG	23.97	26.25	29.124	29.23	28.48	30.49	33.15	32.75	31.54	33.35
6.00	DISCHG	36.836	94.24	167.79	192.99	203.02	208.58	212.15	214.83	216.95	218.64
8.50	DISCHG	220.03	221.17	222.129	222.93	223.63	226.42	229.56	228.51	226.46	228.33
11.00	DISCHG	231.11	229.86	227.63	229.37	234.76	424.93	650.14	721.11	739.12	799.95
13.50	DISCHG	869.32	887.05	892.60	979.09	1082.28	1109.46	1127.31	1773.75	2557.67	2768.13
16.00	DISCHG	2807.92	2146.49	1321.59	1106.64	1055.30	958.34	852.91	826.87	818.68	520.85
18.50	DISCHG	180.81	93.69	75.31	68.73	65.73	67.27	69.78	68.24	65.68	65.01
21.00	DISCHG	64.852	64.81	64.81	64.81	64.81	64.81	64.81	64.81	64.80	64.80
23.50	DISCHG	64.81	64.81	64.372	39.94	10.16	2.30	0.48	0.04	0.00	

TOTAL WATER, IN INCHES ON DRAINAGE AREA= 31.4655 CFS-HRS= 9280.26 ACRE-FT= 766.92

SUBROUTINE RESVOR STRUCTURE 1
SURFACE ELEVATION= 930.00

PEAK TIMES	PEAK DISCHARGES	PEAK ELEVATIONS
15.93	2810.754	933.87

HYDROGRAPH, TZERO= 1.00 DELTA T= 0.25 DRAINAGE AREA= 0.45

TIME											
1.00	DISCHG	0.00	0.01	0.07	0.20	0.41	0.68	0.99	1.35	1.75	2.19
1.00	ELEV	930.00	930.00	930.00	930.01	930.02	930.03	930.05	930.06	930.08	930.10
3.50	DISCHG	2.64	3.10	3.60	4.12	4.63	5.14	5.60	6.24	6.77	7.30
3.50	ELEV	930.13	930.15	930.18	930.20	930.23	930.25	930.28	930.31	930.33	930.36
6.00	DISCHG	7.86	9.04	13.94	22.65	31.82	44.77	60.19	74.47	87.64	104.58
6.00	ELEV	930.39	930.45	930.57	930.74	930.91	931.08	931.23	931.36	931.49	931.59
8.50	DISCHG	119.64	132.89	144.54	154.78	174.72	190.62	202.43	210.84	216.10	219.67
8.50	ELEV	931.68	931.76	931.83	931.89	931.95	931.99	932.02	932.05	932.06	932.07
11.00	DISCHG	222.84	225.26	226.56	227.03	228.62	260.61	369.58	530.78	651.96	723.44
11.00	ELEV	932.08	932.09	932.09	932.09	932.09	932.10	932.59	932.60	932.73	932.81
13.50	DISCHG	791.04	844.01	871.96	916.02	1012.69	1082.72	1112.75	1597.16	2106.01	2698.44
13.50	ELEV	932.88	932.94	932.97	933.01	933.06	933.10	933.11	933.27	933.61	933.83
16.00	DISCHG	2793.74	2457.00	1713.35	1292.99	1114.47	1023.83	924.30	864.84	839.27	758.65
16.00	ELEV	933.87	933.74	933.44	933.21	933.11	933.07	933.01	932.96	932.94	932.83
18.50	DISCHG	505.32	334.37	242.01	189.28	153.52	142.09	132.43	124.11	116.61	109.88
18.50	ELEV	932.58	932.32	932.13	931.98	931.88	931.81	931.76	931.71	931.66	931.62

21:00	DISCHG	103.28	98.84	94.37	90.49	87.37	85.27	83.37	81.64	80.07	78.65
21.00	ELEV	931.59	931.56	931.53	931.51	931.49	931.47	931.45	931.43	931.42	931.41
23.50	DISCHG	77.36	76.19	75.11	72.97	68.51	62.71	57.00	51.71	46.90	42.53
23.50	ELEV	931.39	931.38	931.37	931.35	931.31	931.25	931.20	931.15	931.10	931.06

TOTAL WATER IN INCHES ON DRAINAGE AREA= 22.24 / 30.6188 / 1.6 CFS-HRS= 9030.54 ACRE-FT= 746.28

ENDCMP 1

EXECUTIVE CONTROL CARD OPERATION= COMPUT, FROM XSECTN/STRUCT 0/ 1 TO XSECTN/STRUCT 0/ 1
STARTING TIME= 0.00 RAIN DEPTH= 0.50 RAIN DURATION= 1.00 RAIN TABLE NO.= 3 SOIL CONDITION= 3
ALTERNATE NO.= 1 STORM NO.= 4

SUBROUTINE RUNOFF STRUCTURE 1
AREA= 0.45 INPUT RUNOFF CURVE= 85.0 TIME OF CONCENTRATION= 0.41
COMPUTED CURVE NO. = 94.0

½ PMF

PEAK TIMES	PEAK DISCHARGES	PEAK ELEVATIONS
5.26	10.406	(RUNOFF)
10.11	109.253	(RUNOFF)
11.08	111.353	(RUNOFF)
15.88	1435.551	(RUNOFF)
20.02	34.872	(RUNOFF)
23.62	32.409	(RUNOFF)

HYDROGRAPH, TZERO= 2.25 DELTA T= 0.25 DRAINAGE AREA= 0.45

TIME											
2.25	DISCHG	0.00	1.78	2.91	4.14	4.93	5.46	6.46	7.63	8.05	8.19
4.75	DISCHG	9.10	10.23	10.40	10.27	11.12	12.55	33.56	62.68	75.53	82.61
7.25	DISCHG	87.54	91.25	94.24	96.69	98.73	100.45	101.90	103.15	104.23	105.17
9.75	DISCHG	107.03	109.01	108.95	108.35	109.60	111.24	110.92	110.10	111.17	114.00
12.25	DISCHG	206.96	321.54	353.41	363.24	394.10	429.16	438.66	442.04	485.49	537.23
14.75	DISCHG	551.23	560.54	882.80	1274.04	1379.89	1400.54	1071.01	659.56	552.39	526.83
17.25	DISCHG	478.47	425.86	412.89	408.82	264.10	90.30	46.79	37.61	34.32	32.82
19.75	DISCHG	33.59	34.85	34.08	32.80	32.47	32.39	32.37	32.36	32.36	32.36
22.25	DISCHG	32.37	32.37	32.37	32.36	32.36	32.37	32.37	32.15	19.94	5.07
24.75	DISCHG	1.14	0.24	0.02	0.00						

TOTAL WATER IN INCHES ON DRAINAGE AREA= 15.3671 CFS-HRS= 4532.29 ACRE-FT= 374.54

SUBROUTINE RESVOR STRUCTURE 1
SURFACE ELEVATION= 930.00

PEAK TIMES	PEAK DISCHARGES	PEAK ELEVATIONS
15.99	1370.048	933.25

HYDROGRAPH, TZERO= 2.25 DELTA T= 0.25 DRAINAGE AREA= 0.45

TIME											
2.25	DISCHG	0.00	0.01	0.06	0.13	0.22	0.32	0.44	0.57	0.72	0.87
2.25	FLEV	930.00	930.00	930.00	930.00	930.01	930.01	930.02	930.02	930.03	930.04
4.75	DISCHG	1.03	1.21	1.39	1.58	1.76	1.97	2.40	3.34	4.68	6.20
4.75	FLEV	930.05	930.06	930.07	930.07	930.08	930.09	930.12	930.16	930.23	930.31
7.25	DISCHG	7.82	9.48	13.04	17.35	21.56	25.64	29.59	33.41	37.93	44.15
7.25	FLEV	930.39	930.47	930.55	930.64	930.72	930.80	930.87	930.95	931.01	931.07
9.75	DISCHG	49.92	55.33	60.33	64.83	68.94	72.80	76.36	79.54	82.44	85.25
9.75	FLEV	931.13	931.18	931.23	931.27	931.31	931.35	931.38	931.41	931.44	931.47
12.25	DISCHG	94.00	116.35	145.38	197.73	254.91	313.88	360.89	392.01	420.11	470.12
12.25	FLEV	931.53	931.66	931.83	932.01	932.17	932.28	932.37	932.43	932.48	932.54
14.75	DISCHG	515.17	539.92	650.41	916.61	1262.13	1369.98	1256.98	927.17	722.96	611.50
14.75	FLEV	932.59	932.61	932.73	933.01	933.20	933.25	933.19	933.01	932.81	932.69
17.25	DISCHG	545.32	488.69	446.55	426.68	391.34	307.47	223.76	166.38	143.19	128.80
17.25	FLEV	932.62	932.56	932.51	932.49	932.42	932.27	932.08	931.92	931.82	931.73
19.75	DISCHG	116.25	105.48	96.16	87.95	82.79	78.10	73.85	69.90	66.48	63.30
19.75	FLEV	931.66	931.60	931.54	931.49	931.45	931.40	931.36	931.32	931.29	931.26
22.25	DISCHG	60.42	57.81	55.44	53.29	51.34	49.57	47.97	46.51	44.60	41.61
22.25	FLEV	931.23	931.20	931.18	931.16	931.14	931.13	931.11	931.10	931.08	931.05
24.75	DISCHG	38.03	35.18	33.35	31.61	29.95	28.38	26.90	25.49	24.16	22.89
24.75	FLEV	931.01	930.98	930.94	930.91	930.88	930.85	930.82	930.79	930.77	930.74

TOTAL WATER IN INCHES ON DRAINAGE AREA= 14.7312 CFS-HRS= 4344.73 ACRE-FT= 359.04

ENDCMP 1

EXECUTIVE CONTROL CARD OPERATION COMPUT. FROM XSECTN/STRUCT 0/ 1 TO XSECTN/STRUCT 0/ 1
STARTING TIME= 0.00 RAIN DEPTH= 1.00 RAIN DURATION= 1.00 RAIN TABLE NO.= 4 SOIL CONDITION= 3
ALTERNATE NO.= 1 STORM NO.= 1

SUBROUTINE RUNOFF STRUCTURE 1
AREA= 0.45 INPUT RUNOFF CURVE= 85.0 TIME OF CONCENTRATION= 0.41
COMPUTED CURVE NO. = 94.0

100-YR.

PEAK TIMES	PEAK DISCHARGES	PEAK ELEVATIONS
11.06	50.065	(RUNOFF)
15.89	642.136	(RUNOFF)
17.87	193.855	(RUNOFF)
20.02	28.401	(RUNOFF)
21.02	28.428	(RUNOFF)
22.02	28.457	(RUNOFF)
23.02	28.415	(RUNOFF)
23.92	28.877	(RUNOFF)

HYDROGRAPH, TZERO= 2.75 DELTA T= 0.25 DRAINAGE AREA= 0.45

TIME											
2.75	DISCHG	0.00	1.67	2.35	3.00	3.61	4.18	4.72	5.23	5.70	6.15
5.25	DISCHG	6.58	6.98	7.36	7.83	14.69	24.07	28.31	30.86	32.85	34.51
7.75	DISCHG	35.97	37.26	38.40	39.43	40.36	41.19	41.94	42.63	43.25	43.82
10.25	DISCHG	44.34	44.85	47.21	49.95	49.06	47.24	48.95	52.05	89.07	134.71
12.75	DISCHG	149.88	156.77	170.07	184.59	189.16	191.26	209.71	231.64	240.24	247.47
15.25	DISCHG	390.78	564.88	614.99	627.55	480.66	295.94	247.89	236.49	213.93	189.25
17.75	DISCHG	185.43	186.32	124.03	48.59	31.44	29.53	26.92	24.33	25.86	28.36
20.25	DISCHG	26.82	24.32	25.96	28.38	26.83	24.29	25.87	28.43	26.83	24.29
22.75	DISCHG	25.88	28.39	26.83	24.33	25.88	28.21	17.85	4.55	1.03	0.21
25.25	DISCHG	0.02	0.00								

TOTAL WATER, IN INCHES ON DRAINAGE AREA= 6.9778 CFS-HRS= 2056.01 ACRE-FT= 170.07

SUBROUTINE RESVOR STRUCTURE 1
SURFACE ELEVATION= 930.00

PEAK TIMES	PEAK DISCHARGES	PEAK ELEVATIONS
16.16	549.074	932.62

HYDROGRAPH, TZERO= 2.75 DELTA T= 0.25 DRAINAGE AREA= 0.45

TIME											
2.75	DISCHG	0.00	0.01	0.05	0.11	0.17	0.25	0.33	0.43	0.53	0.64
2.75	ELEV	930.00	930.00	930.00	930.00	930.00	930.01	930.01	930.02	930.02	930.03
5.25	DISCHG	0.76	0.88	1.01	1.15	1.35	1.72	2.22	2.78	3.38	4.00
5.25	ELEV	930.03	930.04	930.05	930.05	930.06	930.08	930.11	930.13	930.16	930.20
7.75	DISCHG	4.63	5.29	5.95	6.63	7.31	7.99	8.68	9.37	10.14	11.89
7.75	ELEV	930.23	930.26	930.29	930.33	930.36	930.39	930.43	930.46	930.50	930.53
10.25	DISCHG	13.57	15.20	16.81	18.47	20.09	21.56	22.95	24.39	26.81	31.26
10.25	ELEV	930.56	930.60	930.63	930.66	930.69	930.72	930.74	930.77	930.82	930.90
12.75	DISCHG	37.90	48.65	59.34	70.33	81.18	92.70	106.85	121.79	136.77	150.83
12.75	ELEV	931.01	931.12	931.22	931.33	931.43	931.52	931.61	931.69	931.78	931.86
15.25	DISCHG	196.75	290.51	407.78	525.29	542.81	440.88	372.85	321.68	283.90	254.24
15.25	ELEV	932.01	932.24	932.45	932.60	932.62	932.52	932.39	932.30	932.23	932.17
17.75	DISCHG	233.09	218.17	198.26	162.48	142.73	127.99	114.89	103.17	92.92	85.36
17.75	ELEV	932.11	932.07	932.01	931.91	931.82	931.73	931.65	931.58	931.52	931.47
20.25	DISCHG	79.98	74.92	70.28	66.26	62.66	59.20	56.03	53.34	50.94	48.58
20.25	ELEV	931.42	931.37	931.32	931.29	931.25	931.22	931.19	931.16	931.14	931.12
22.75	DISCHG	46.39	44.60	43.01	41.39	39.87	38.68	37.22	35.32	33.62	31.89
22.75	ELEV	931.09	931.08	931.06	931.05	931.03	931.02	931.01	930.98	930.95	930.92
25.25	DISCHG	30.23	28.65	27.15	25.73	24.38	23.11	21.90	20.75	19.67	18.64
25.25	ELEV	930.88	930.85	930.82	930.80	930.77	930.75	930.72	930.70	930.68	930.66

TOTAL WATER, IN INCHES ON DRAINAGE AREA= 6.4282 CFS-HRS= 1895.91 ACRE-FT= 156.67

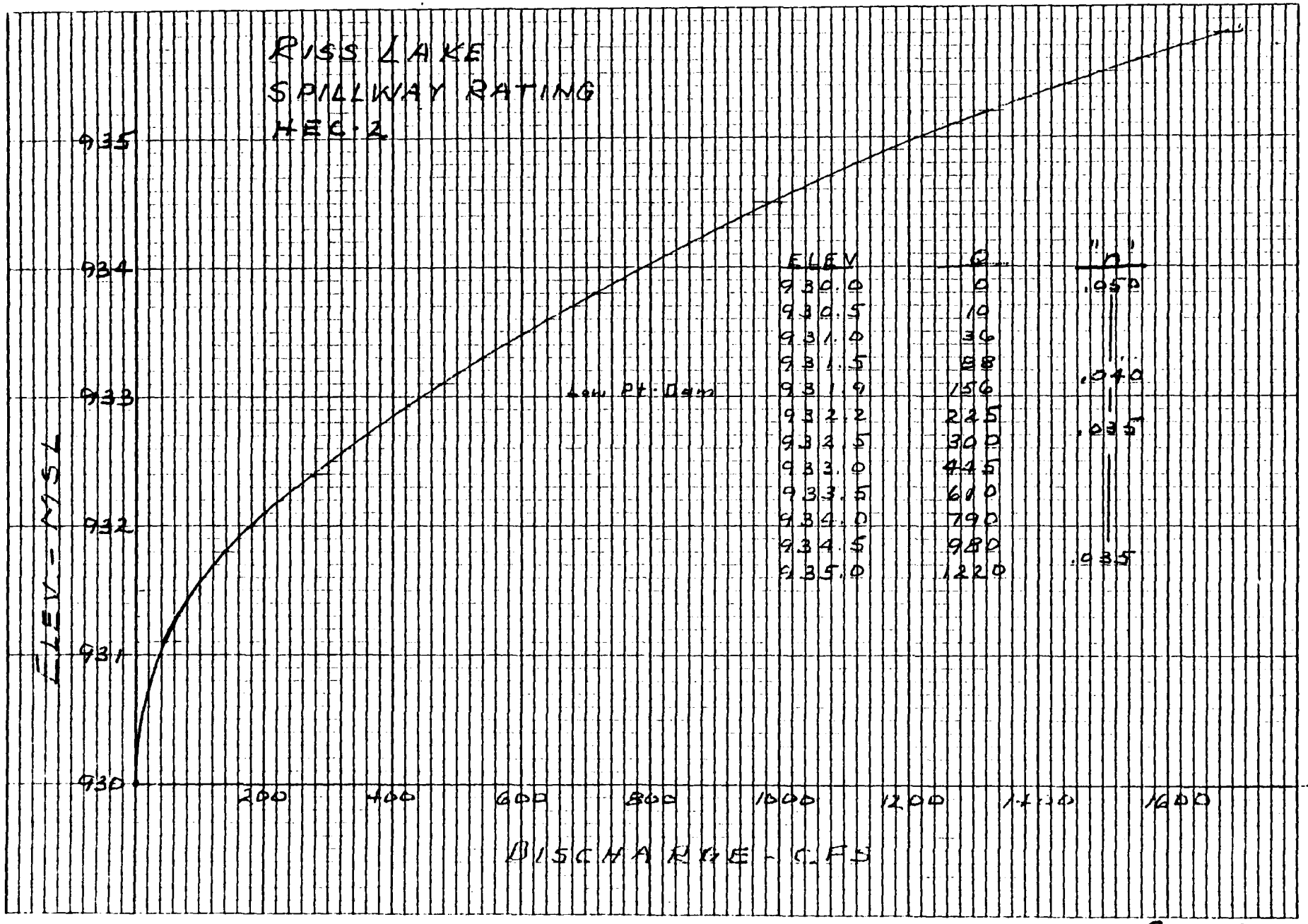
ENDCMP 1

END OF JOB TR20 GGJ

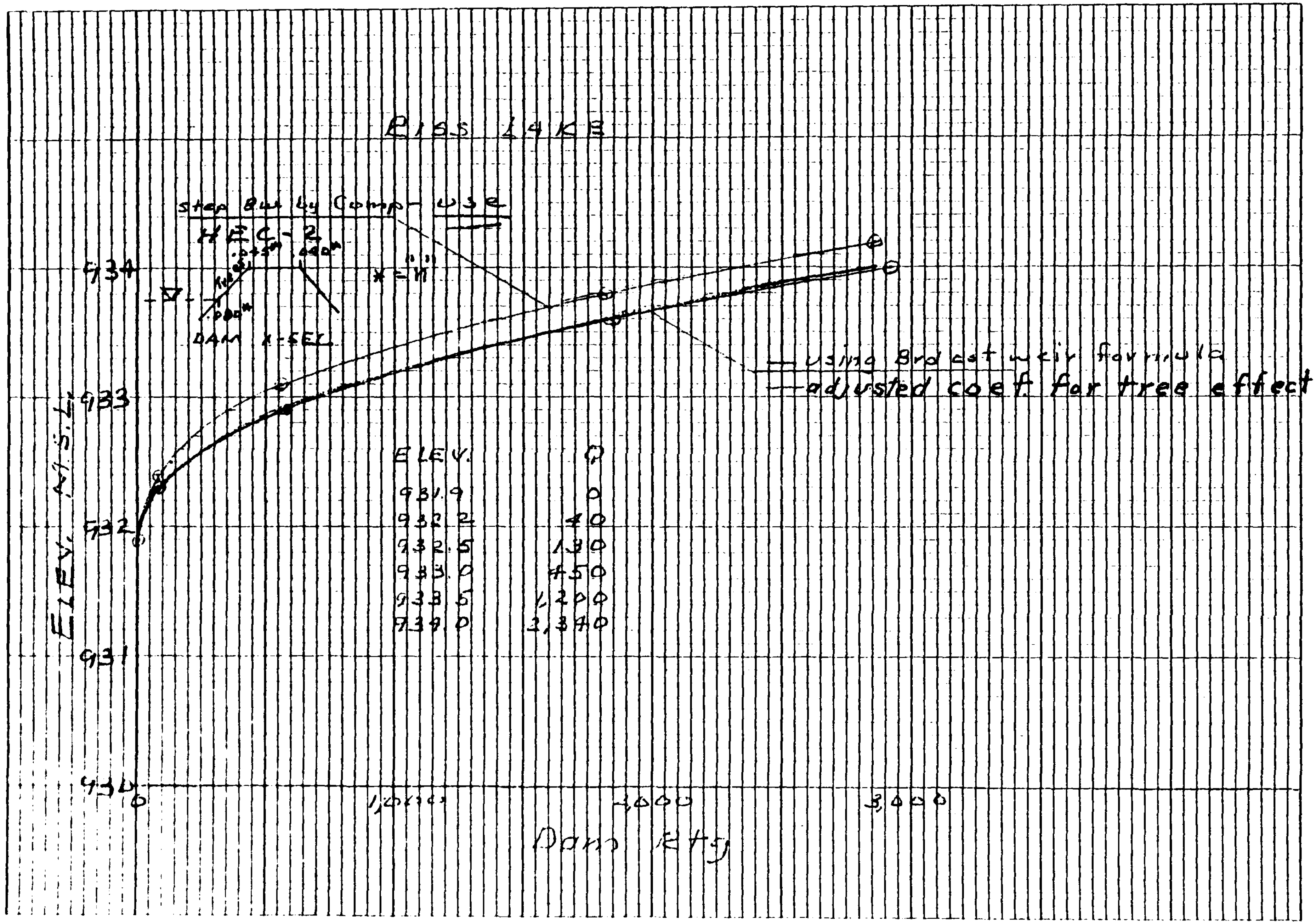
BATCH JOB

7 OF 10

RISS LAKE
SPILLWAY RATING
HEC-2



ELEV	Q	"n"
930.0	0	.050
930.5	10	
931.0	36	
931.5	88	
931.9	156	.040
932.2	225	
932.5	300	.035
933.0	415	
933.5	610	
934.0	790	
934.5	980	
935.0	1220	.035



HOSKINS-WESTERN-SONDEREGGER

CALCULATIONS FOR

COMPUTED BY GGJ DATE 10/19/78 SHEET NO. ____ OF ____

CHECKED BY ____ DATE ____ JOB NUMBER 79/3095

PROJECT Mo Dam Ins. F.

Combined Rating — Riss Lake

Elev.	Spillway	Dam Embank	Total
930.0	0		0
930.5	10		10
931.0	36		36
931.5	88		88
Fl-Com 931.9	156	0	156
932.2	225	40	265
932.5	300	130	430
933.0	445	450	895
933.5	610	1200	1810
934.0	790	2340	3130